Gulf Cooperation Council

EDICT OF GOVERNMENT

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GSO 57 (1987) (English): INDUSTRIAL SAFETY AND HEALTH REGULATIONS HAZARDOUS MATERIALS — GASES PART 3: HYDROGEN

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STANDARDIZATION ORGANIZATION FOR G.C.C (GSO)

GSO 57/1987

اشتراطات السلامة والصحة الصناعية
المواد الخطرة – الغازات
الجزء الثالث : الهيدروجين

INDUSTRIAL SAFETY AND HEALTH REGULATIONS
HAZARDOUS MATERIALS — GASES
PART 3: HYDROGEN

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INDUSTRIAL SAFETY AND HEALTH REGULATIONS
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INDUSTRIAL SAFETY AND HEALTH REGULATIONS
HAZARDOUS MATERIALS — GASES
PART 3: HYDROGEN

1. SCOPE AND FIELD OF APPLICATION

This Standard is concerned with the industrial use of gaseous and liquefied hydrogen and manufactured gases when hydrogen content exceeds 30 percent.

2. COMPLEMENTARY REFERENCES

2.1 GSO 55/1987 “Industrial Safety and Health Regulations - Hazardous Materials - Gases - Part 1: General Requirements”.

2.2 GSO 220/1994 concerned with Industrial Safety and Health Regulations - Welding, Cutting and Brazing.

2.3 GSO 218/1994 concerned with Industrial Safety and Health Regulations - Equipment - Tanks, Pressure Vessels, Boilers and Compressed Gas Equipment.

3. REGULATIONS

3.1 Gaseous Hydrogen Systems

Containers for gaseous hydrogen systems shall be designed and installed in accordance with the Gulf Standard mentioned in item 2. 1.

Safety relief devices shall be installed to comply with the Gulf Standard mentioned in item 2. 1.

Piping, tubing, and fittings shall comply with the Gulf Standard mentioned in item 2. 1, and as follows:

a) Cast iron pipes and fittings shall not be used.

b) Compression fittings may be used for tubing.

3.1.1 Equipment

Valves, regulators and accessories shall comply with the Gulf Standard mentioned in item 2.1 and as follows:

3.1.1.1 Cabinets or housings containing hydrogen control or operating equipment shall be ventilated to maintain atmospheric conditions below the lower explosive limit of hydrogen.

3.1.1.2 Each mobile hydrogen supply unit used as part of a hydrogen system shall be secured to prevent accidental movement.

3.1.1.3 Mobile hydrogen supply units shall be electrically bonded to the system before discharging hydrogen.

3.1.2 Location System location shall comply with the Gulf Standard mentioned in item 2.1 and as follows:

3.1.2.1 The location of the system, as determined by the maximum total contained volume of hydrogen, shall be in the order of preference as indicated in Table 1.

3.1.2.2 The minimum distance from a hydrogen system located outdoors, in separate buildings, or in special rooms to any specified outdoor exposure shall be in accordance with Table 2.

3.1.2.3 Location of hydrogen systems of less than 85 cu m when located inside buildings anct exposed to other occupancies shall be as follows:

a) In an adequately ventilated area.

b) 6 m from stored flammable materials or oxidizing gases.

c) 8 m from open flames, ordinary electrical equipment or other sources of ignition.

d) 8 m from concentrations of people.

e) 15 m from intakes of ventilation or air-conditioning equipment and air compressors.

f) 15 m from other flammable gas storage.

g) Protected against damage from falling objects or working activity in the area.

h) More than one system of 85 cu m or less may be installed in the same room, provided the systems are separated by at least 15 m. Each system shall meet all of the requirements of this standard.

Table 1

Location of Gaseous Hydrogen Systems

Location	Capacity of Hydrogen System (cu m and standard conditions)		
	Less than 85	85 to 425	Excess of 425
Out doors	1	1	1
In separate buildings	2	2	2
In special rooms	3	3	Not permitted
Inside buildings not in special room And exposed 10 other occupancy	4	Not permitted	Not permitted

3.1.3 In ventilated areas air inlets and outlets openings shall have one sq. m/300 cu. m of room volume.

3.1.4 Explosion venting area shall be not less than one sq M/9 cu m of room volume.

3.1.5 The area within 5 m of any hydrogen container shall be kept free of dry vegetation and combustible material.

3.2 Liquefied Hydrogen Systems

3.2.1 Containers shall be designed, marked, and installed in accordance with the Gulf Standard mentioned in item 2.1.

Table 2

Distance in Meters Between Hydrogen System and Other Objects

Objects	Size of Hydrogen system (cu m and standard conditions)		
	Less than 85	85 to 425	In excess of 425
1. Building or Structure Wood Frame Construction	3	8	17
Heavy timber or non-combustible ordinary construction	0	3	8
Fire resistive construction	0	0	3
2. Wall Openings			
Not above any part of system	3	3	3
Above any part of system	8	8	8
3. Flammable			
0 to 3800 liters	3	8	8
In excess of 3800 liters	8	15	15
4. Flammable Liquids, below ground, 0 to 3800 liters			
Tank	3	3	3
Vent or filling opening of tank	8	8	8
5. Flammable Liquids, below ground 3800 liters and more			
Tank	6	6	6
Vent or filling opening of tank	8	8	8
6. Flammable Gas Storage, either high or low pressure			
0 - 425 cu m	3	3	3
In excess of 425 cu m	8	17	17

(Table continued)

Objects	Size of Hydrogen system (cu m and standard conditions)		
	Less than 85	85 to 425	In excess of 425
7. Oxygen storage 340 cu m or less	6 cu m from any hydrogen system*		
More than 340 cu m	8 for 700 cu m hydrogen 15 for excess of 700 cu m		
8. Fast Burning solids excelsior, Paper, etc.	17	17	17
9. Slow Burning Solids – Coal, Timber, ect.	8	8	8
10. Open flames and other sources of ignition	8	8	8
11. Air compressor intakes or inlets to ventilating or air conditioning equipment	17	17	17
12. Concentration of people, offices, Lunchrooms, locker rooms, etc.	8	17	17

***Note**: Distances in 1, 14 and 3 to 10 inclusive do not apply where protection such as adequate fire walls are located between system and exposure.*

* For gas welding see the Gulf Standard mentioned in item 2.2.

3.2.2 Safety relief devices shall comply with the Gulf Standard mentioned in item 2.1. Safety relief devices shall be provided wherever liquefied hydrogen can be trapped.

3.2.3 Piping, tubing, and fittings shall comply with the Gulf Standard mentioned in item 2.1.

3.2.4 Equipment.

Valves, regulators, other accessories shall comply with the Gulf Standard mentioned in item 2.1 and on containers of 7600 liters or more capacity shut off valve shall be of remote control type.

3.2.4.1 Vaporizers shall comply with the Gulf Standard mentioned in item 2.1 except that a low temperature shut off switch shall be provided in the vaporizer discharge piping to prevent flow of liquid hydrogen in the event of loss of heat source.

3.2.4.2 Electrical wiring and equipment located within 1 m of a point where connections are regularly made and disconnected, shall be in accordance with Class 1, Group B, Division 1 locations. (See the Gulf Standard mentioned in item 2.3).

3.2.4.3 Except as provided in item 3.2.4.2 electrical wiring and equipment located within 8 m of a point where connections are regularly made and disconnected or within 8 m of a liquid hydrogen storage container, shall be in accordance with Class 1, Group B, Division 2 locations. When equipment approved for Class 1, Group B atmospheres is not commercially available, the equipment may be purged or ventilated in accordance with relevant Gulf Standards for purged enclosures for electrical equipment in hazardous locations, intrinsically safe, or approved for Class 1, Group C atmospheres. This requirement does not apply to electrical equipment which is installed on mobile supply trucks or tank cars from which the storage container is filled.

3.2.4.4 The container and associated piping shall be electrically bonded and grounded.

3.2.5 Location shall comply with the Gulf Standard mentioned in item 2.1 and as follows:

3.2.5.1 The location of liquefied hydrogen storage, as determined by the maximum total quantity of liquefied hydrogen, shall be in the order of preference as indicated in Table 3.

Table 3

Location of Liquefied Hydrogen Storage

Nature of Location	Size of Hydrogen Storage (Capacity in Litres)			
	150 to 190	191 to 1135	1136 to 2271	In excess of 2271
Outdoors	1	1	1	1
In a separate building	2	2	2	2
In special room	3	3	3	3
Inside buildings not in a to other occupancies	4	Not Permitted	Not Permitted	Not Permitted

***Note**: This table does not apply to the storage in Dewar flask of the type generally used in laboratories for experimental purposes.*

3.2.5.2 For handling of liquefied hydrogen inside buildings other than separate buildings and special rooms, portable liquefied hydrogen containers of 190 liters or less capacity as permitted in Table 3, shall be located as specified in gaseous hydrogen systems 85 cu m or less (Table 1).

3.2.5.3 The minimum distance from liquefied hydrogen systems located outdoors, or in special room to any specified exposure shall be in accordance with Table 4.

Table 4

Minimum Distance (Meters) from Liquefied Hydrogen System to Exposure, Outdoor, in Buildings, Special Rooms

Type of exposure	Liquefied hydrogen storage (Capacity in litres)		
	150 to 13000	13001 to 57000	57000 to 114000
Fire-resistive building and fire walls	2	2	2
Noncombustible building	8	15	23
Other buildings	15	23	30
Wall openings, air compressor intakes, inlets for air conditioning or ventilating equipment			
Flammable liquids (above ground and vent or fill openings if below ground)	15	13	30
Between stationary liquefied hydrogen containers	2	2	2
Flammable gas storage	15	23	30
Liquid oxygen storage and other oxidizers	30	30	30
Combustible solids	15	23	30
Open flames, smoking, and welding	15	15	15
Concentrations of people	23	23	23

3.2.6 Requirements for ventilation and explosion venting shall be as for gaseous hydrogen systems in items 3.1.3 and 3.1.4 respectively.

3.2.7 Operating and Maintenance Instructions.

For installations which require any operation of equipment by the user, legible instructions shall be maintained at operating locations.

3.2.8 A qualified person shall be in attendance at all time,, while the mobile hydrogen supply unit is unloaded.

3.2.9 Each mobile liquefied hydrogen supply unit used as part of a hydrogen system shall be secured to prevent movement.

3.2.10 The mobile liquefied hydrogen supply unit shall be grounded for static electricity.

3.2.11 The equipment and functioning of each charged liquefied hydrogen system shall be maintained in a safe operating condition in accordance with the requirements of this standard. Weeds or similar combustibles shall not be permitted within 8 m of any liquefied hydrogen equipment.